2 FEB 1959.

metric measures

(JOURNAL OF WEIGHTS AND MEASURES)

STANDING METRIC COMMITTEE
MINISTRY OF COMMERCE AND INDUSTRY

Vol. 2 JANUARY 1959 (PAUSA 1880) No. 1

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Cover design by R. Sarangan

Annual Subscription Rs. 2.00 **Single Copy 40nP.**

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METRIC MEASURES is published every two months.

METRIC MEASURES provides information to the general public on the administrative, commercial, educational, industrial, historical and other aspects of weights and measures, with particular reference to the introduction of the metric system in India.

Contributions for publication should be sent to the Editor, METRIC MEASURES, Standing Metric Committee, Ministry of Commerce & Industry, Udyog Bhavan, New Delhi.

Enquiries regarding subscriptions and supply of copies should be addressed to the Business Manager, Publications Division, Ministry of Information and Broadcasting, Old Secretariat, Delhi-8.

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MADRAS

Prime Minister on Metric Reform

As you know, some time back we decided to adopt the metric system and it is coming gradually. It is proper to do so and we do not want to bring it rapidly. People have often complained that we want to disturb all the old customs and conventions and ancient ways of calculations. The answer to them is very simple : Yes sir, not only do we want to disturb them but also to uproot and throw them away. Anything that is worthless, whether new or old, cannot prove to be good. Nothing becomes good by just being old or new. If anything new is beneficial and conducive to efficient work and leads us to progress then we have got to adopt it. We have also to keep in view that the world has changed and is changing. In this changed world, weights and measures also have to change.

Now, just see, how difficult it will be without metric weights and measures—in the context of the advances made by physics and atomic energy, the sun and the moon—if we try to measure the distances to the sun and the moon in terms of yards. For these measures different units have been laid down and they are very essential.

The complaint about disturbing old ways is very strange. The metric system is a glorious and great invention of India and the Indian mind. It is ours in the same way as our invention of the sign of zero. This famous sign was invented by some great genius of India and we do not even know his name. But the truth remains that it was evolved by an Indian mind.

And then we also learn tables of 2½, 2¾, and 3½ in our arithmetic. I also learnt them in my childhood and probably they are taught to the children today also. But can we succeed in the world with these tables ? So we have to pick up the metric system and I say that if we want to progress and make the country go ahead then we must enforce it. Without it the country cannot progress and will continue to remain in the old rut. The metric system has arrived. It it coming and will come. But the difficulty is that we have to urge some people onwards and make them go ahead. They lag far behind and refuse to go ahead. But the changing world also has its effect on them.

JAWAHARLAL NEHRU

(Extract translated from the Inaugural Speech at ISI Convention on 24 November 1958).

Reform of Indian Weights and Measures—First Phase

P.N. NAYER
Secretary,
Standing Metric Committee,
New Delhi

WEIGHTS and measures concern almost everybody. We are apt to regard them merely as tools for the exchange of goods. This is a very restricted view of their role in life. They enter into every aspect of human endeavour. A clear and rational system of measurement is essential for the precise expression of thought and exchange of ideas. No progress, economic or cultural, is possible without such a system. The ability to measure accurately is a reliable index of progress in science and technology.

India does not lack systems of weights and measures. It has evolved many and they still flourish. In weights and measures, however, diversity breeds chaos, and we have decided to have one system for the whole country, the metric system.

Although a product of French genius, the metric system, as Prof. Haldane remarked in a recent article, has roots in ideas which originated in India. Its superiority over the rival systems is no longer a subject of dispute or controversy. Other systems, where they survive, are tolerated because, being established by long usage, their removal is difficult and costly. The reform of Indian weights and measures, affecting as it does, the lives of nearly a sixth of the world population is of significance to the whole world. Naturally, there have been interested and lively comments in the press the world over.

Why Gradual Reform

A sweeping reform of this nature must be gradual and brought about by stages. An abrupt change will create chaos and cause needless loss to the State and the public. Millions of weights and measures, weighing and measuring instruments and equipment of various kinds will have to be scrapped. If the change is gradual, it will be possible to make the fullest possible use of the present equipment using it till it falls due for replacement by normal wear. Even the USSR took nearly 10 years to discard their indigenous weights and measures. Japan, where the reform will be complete on 1 January 1959, took even longer. In India the law allows a transitional period of 10 years. which will end in December 1966. During this period, the metric system may be introduced by convenient stages. Government may introduce it, to begin with, in certain areas or in certain trades, industries or other fields. Later, they may extend it to other areas or fields of activity. Where it is first introduced, the continued use of older systems may be permitted for a period of upto 3 years. The metric system will not, therefore, come as a bolt from the blue. First it will be recognized and permitted along with the older systems. Its use will be voluntary in the beginning and after a time when people get familiar with it, it will be made compulsory.

The law to adopt the metric system was enacted in December 1956 but its

enforcement required much preparation. Arrangements had to be made for the manufacture of new weights and their verification and certification by the proper authorities. Luckily, the country has a large capacity for the production of weights and the manufacturers are eager to play their part. The manufacturers had to be licenced and facilities provided for the verification of the weights produced. The States had to enact laws, frame rules and organize agencies for enforcing them. Standard weights and measures had to be provided to State Inspectorates for the verification of commercial weights and measures. The Government Mint is the only organization in the country which can manufacture standards of the precision needed. It was also necessary to publicize the new weights and measures so that the public might use them with facility and ease. These preparations have made good progress. Most States have enacted laws for enforcing the new weights and measures and set up the necessary organizations. Standards for Inspectors have been supplied to all States by the Mints. The new weights and measures have received fair publicity in the press and also through visual media such as posters, documentary film, demonstration of weights and talks broadcast over the All India Radio. Metric weights and measures have, therefore, now been introduced on a small scale.

Extent of the Beginning

The law for the adoption of the metric system is now in force in regard to weights in certain areas. The area is substantial in certain States, particularly Bihar, where it includes the entire divisions of Bhagalpur and Ranchi. For the time being the law has been applied only to the purchase and sale of goods. Transactions of other kinds such as the levy of taxes by the Central, State or Municipal authorites, or charging for the transport of passengers and goods, will continue on the existing system. It would not be feasible for the Railways, the Post offices, the Customs Houses or the Excise department to use metric weights in certain areas and the pound or seer weights in others. They will begin using metric weights and measures for all purposes throughout the country as soon as the necessary preparations are complete.

The use of metric weights is not obligatory even where the law is in force. It is only permissive. There being no compulsion, people will continue using the pound and seer weights in their possession. The option to use them will cease after 2 years. Traders and other users of weights in these areas would be well advised to replace their weights, when it becomes necessary, by metric weights.

The law has also been applied to Government departments for certain purposes such as purchase of stores. At present while they have the option to use metric units there is no compulsion. There is little doubt that soon in indents, tenders and contracts connected with stores purchases, quantities and prices will be expressed in metric units. The two national airlines have been allowed to use metric units in booking luggage and freight. Air distances and speeds will continue to be measured in nautical miles and knots, These units are used the world over for these purposes, and recognized by the International Civil Aviation Organization. The Meteorological Department began using the metric system even before the law came into force. In January 1957 they began recording data and publishing weather reports in metric units. This was done to avoid a change in the middle of the International Geophysical Year, which began in July 1957. They wanted the entire data collected during the International Geophysical Year to be in the metric system of units.

Textile Industry

The metric system has been introduced in a number of major industries including cotton and jute textiles, iron and steel, non-ferrous metals, engineering, cement, heavy chemicals, paper and salt. It is confined, for the time being, to purchases and sales by industrial establish-

ments. A cotton mill, for instance, may buy raw cotton from the supplier in kilograms. The supplier would buy from the grower or other source in maunds or candies and sell to the mill in kilograms. Likewise, the mill may sell cloth and yarn in metres and kilograms but the buyer would sell to his customers in yards and pounds. The burden of conversion will thus fall, not on the cotton grower or the consumer of cloth, but on the middlemen who deal with the mills. Cloth will be marked in both yards and metres but there will be no immediate change in the lengths or widths of the pieces. Ultimately, however, both will be standardized in metres. The weight of raw cotton bales will be marked in kilograms as well as maunds or candies but there will be no change in the weight. Later, the weights will be standardized in kilograms. We may hope that the opportunity will be taken to reduce the number of standard sizes of bales. The East India Cotton Exchange and other forward markets in cotton will use metric units in regulating forward trade. They may, for some time, record quantities and prices in terms of both kilograms and maunds or candies.

Jute Industry

The metric system came into use in the jute industry on 1 July 1958, three months earlier than other industries This was a convenient date for the industry, being the beginning of the crop year for jute. Since July jute mills have been expressing quantities and prices in metric units in buying raw jute or selling jute manufactures. There has been no change in the size of bales, whether of raw jute or jute cloth, or the specifications for cloth and yarn. The size of raw jute bales can be standardized in metric units only after the metric system is established in trade in the growing areas. A very large part of the jute manufactured in India is exported. The present specifications for jute goods meet the demand of the main markets for jute goods abroad. Whether it is necessary and economic to produce goods of a different quality for the home market is for the industry's consideration. Importers of jute goods abroad have been assured that they would continue to receive the qualities they want, packed and invoiced in the manner they have been accustomed to.

Iron and Steel

The main producers of iron and steel will sell iron and steel products in metric tonnes (1,000 kilograms) instead of long tons. They will also use metric units in buying raw materials and fuels. The Indian Standards Institution has published specifications in metric units for steel sections. These specifications incorporate the best in recent experience, combining utility with economy in the use of steel. The 3 new State-owned steel plants nearing completion and the recent extensions of the capacity of the older enterprises in the private sector will be able to manufacture the new sections. The adoption of these sections will bring about economy in the use of steel, which is in short supply in the country today.

Engineering Industry

The engineering industry will begin to use metric weights in selling its products. The adoption of metric length measures will be a more arduous task since it will entail redesigning of many of its products. It would be possible to retain the present dimensions of products by merely expressing them in metric units. These converted values will have inconvenient fractions or decimals and the main advantage of the metric system, namely simplicity, will be lost. Redesigning is, therefore, inevitable but has to be a slow process and can begin only after the basic standards in metric units are available. A few of these standards have been published by the Indian Standards Institution ; it is working diligently to complete the others. The industry has also to provide itself with tools, gauges and instruments graduated in metric units. It is hoped all machinery installed in future, whether produced in the country or imported, will be capable of manufacturing products according to metric standards.

Heavy Chemicals and Other Industries

Heavy chemicals, salt, cement and paper will be sold by the metric tonne or

kilogram. Paper sizes have been standardized in millimetres. Manufacturers will adopt these sizes when printers and other users of paper are ready to use them.

Cement will continue to be sold for the time being in bags of gross weight 1 cwt, equivalent to 50.8 kilograms. The gross weight will be marked in kilograms also. The net weight of cement in a bag being only a fraction of a kilogram in excess of 50 kilograms it will be possible to reduce it to 50 kilograms, using the same type and size of bags.

A bag of salt will contain 75 kilograms. The cess on salt will be in naye paise per kilogram, although there will be no change in the rates.

Other Major Industries

Tea, sugar and petroleum are major industries where the metric system has not yet been introduced. Representative associations of the tea industry and trade have agreed to the adoption of the metric system from 1 April 1960 in the sale of tea and in the payment of wages for plucking green tea leaves, and from 1 April 1959 in recording areas under tea. From April 1960 tea may be sold in kilogram or half kilogram packages. Care will be taken that tea for export is packed and invoiced according to the desire of the buyers overseas.

The Development Council for Sugar had suggested that from the beginning of season 1958-59, sugar mills should buy cane and sell sugar in quintals (100 kilograms) or metric tonnes (1,000 kilograms). Although the suggestion could not be carried out, the minimum price of sugarcane for the current season was notified in maunds as well as quintals. Certain factories in areas where the use of metric weights is permissible have begun buying cane in quintals. They are entitled to do so because in these areas metric weights may be used in transactions of all kinds. The introduction of the metric system in the industry as a whole cannot possibly be long delayed.

The petroleum industry has agreed to adopt the metric system for all purposes from 1960. The main pre-requisite for the sale of petrol in litres instead of gallons is the conversion of over 10,000 dispensing pumps in use in the country.

Past Vs Present

There are sceptics who consider the present programme for the reform of weights and measures to be far too ambitious. Past experience in this field does not, they say, encourage the belief that the variety of weights and measures now prevalent can be superseded in the course of a decade. There is one important difference between the past and now. Then, except in one or two States, there was no special organization for enforcing weights and measures. The work was left to the regular police who had neither the time nor the special skill and aptitude for it. A variety of special organizations are required for enforcing special laws in a modern state. There are, for instance, special organizations for enforcing laws regulating working conditions in factories, food adulteration, sanitation and health and so on. We have learned by experience that laws on weights and measures also require an organization with specially qualified and trained personnel for their proper enforcement. The State Governments have decided to set up these organizations and begun recruiting and training the staff. There is no cause, therefore, to lose faith in our capacity to standardize weights and measures by adopting the metric system within the decade allowed by law.

Metric System in French Secondary Schooling

GUY KNOCHE
French Economic & Technical Bulletin,
France

AT the age of eleven to twelve years the young student who is to receive secondary education enters the sixth class. Six years later, when he has reached the first class, he will have to pass an examination, the first part of the graduation certificate ('baccalaureate' in French), required for university studies, which will permit him to undertake the second and more specialized part of the baccalaureate. He is then 18 to 19 years old and may go in for higher education.

During the entire seven years of secondary schooling, our young student will utilize, whether in mathematics or in physics, the metric and decimal systems with which he has become familiar during the years of primary schooling. As we shall see, it is on the basis of this system that he will gradually acquire his knowledge of the sciences.

In Sixth Class

During this first year of secondary education, the child will not be confronted with any new knowledge. It is a year of transition, primarily intended to initiate the child into the methods of secondary schooling : different teachers for different courses, personal work, and so on. For the mathematics teacher, it offers the opportunity of checking on the basic knowledge of the pupils. Three hours per week are devoted to mathematics and the details of the curriculum show that these courses are designed particularly as a means of teaching the children the first elements of exact mathematical reasoning, by ensuring at the same time perfect understanding of the simple operations of arithmetical calculation : standard problems involving whole and decimal numbers and a few simple fractions. These studies are quite naturally related to the essential units : length, surface and volume, time, weight, speed, measurement of angles. This gives rise to numerous practical exercises requiring the use of a variety of instruments or apparatus of measurement : graduated rules (metre and decimetre), slide calipers, micrometers, opisometers, protractors, scales and watches.

At the end of the first year of secondary schooling, the pupil will thus be perfectly familiar with the metre, angular degrees, the second and the gram as well as with the multiples and submultiples of these fundamental units. He will also once again be able to observe the ease with which he can pass, thanks to the decimal system, from the lower to the higher units and *vice versa*, by simply shifting the decimal point ('comma' in French) to the right or left*.

*In French practice, the comma is used in place of the English decimal point and the point has been used for the separation of groups of three figures. A recent French law eliminates the use of the point altogether and groups of three figures are now separated by a space as shown in the following example : 38 325 108,1 m = 3 832 510,81 dam = 383 251 081 hm = 38 325,108 1 km,

In Fifth Class (Three Hours per Week)

Beginning with this class, the division of mathematics into several branches (arithmetic and geometry) is effected. Here we shall concern ourselves only with arithmetic. The curriculum for arithmetic covers the progressive construction of numbers, the definitions relating to their comparison and to their combination by the elementary operations as well as the presentation of their fundamental properties. The importance of these concepts is evident from the fact that the pupil who was until now used to the handling of concrete numbers, is now required to learn generalization and abstraction and pick up with ease the utilization of symbols. Algebra is built up on this basis during the following year.

The constant handling of the four operations (addition, subtraction, multiplication and division) requires the use of the principles of the decimal system. For example, the student will be asked to solve a problem like the following :

'In substracting 534 from 367, a careless student forgets to carry over. Without effecting the operation, find the amount of his error'.

The student will immediately perform the operation and find : (1) the correct result, 167 ; (2) the erroneous result, in this case, 277 ; and (3) the amount of the error, 110.

At this stage the facility of reasoning made possible by the decimal system leads to the following correct method :

$$\begin{aligned} 534 &= 400 + 120 + 14 \\ 367 &= 300 + 60 + 7 \\ \text{or}\quad 534 - 367 &= (400 + 120 + 14) - (300 + 60 + 7) \\ &= (400 - 300) + (120 - 60) + (14 - 7) \\ &= 100 + 60 + 7 \\ &= 167 \end{aligned}$$

The wrong method would be :

$$\begin{aligned} 534 &= 500 + 30 + 4 \\ 367 &= 300 + 60 + 7 \\ \text{or}\quad 534 - 367 &= (500 + 30 + 4) - (300 + 60 + 7) \\ &= (500 - 300) + (30 - 60) + (4 - 7) \end{aligned}$$

and, to make the operation feasible, *in omitting the carry-over*, by adding to each lower number one unit of the higher place (therefore, 10 units of the same place):

$$\begin{aligned} 534 - 367 &= (500 - 300) + (100 + 30 - 60) + (10 + 4 - 7) \\ &= (500 - 300) + (130 - 60) + (14 - 7) \\ &= 200 + 70 + 7 \\ &= 277 \end{aligned}$$

Returning to the original form :

$$\begin{array}{r} 534 \\ -367 \end{array}$$

the child is thus led to observe that the final result has been raised by a unit of second place (10) and by a unit of the third place (100) and consequently by a total of 110.

In a simpler form, he observes that in the correct operation the unit of the second place (ten) added to the first number in the form of 10 units of the first place, is subsequently added to the second number (in the form, this time of a single unit of the second place) and so on for the higher places.

The pupil of the fifth class (aged 12 or 13 years), after having understood its mechanism, can extend this observation—this time without recourse to practical experience—to all possible cases.

Let us take the following example of substraction :

$$\begin{array}{r} 36\ 692 \\ -17\ 823 \end{array}$$

If we forget the carry-over, the error will first apply to a unit of the second place (since, in the column of units of the first place, 2 is smaller than 3 and because 3 should have been subtracted from 12 and not 3 from 2), or an error of 10. On the other hand, in the column of units of the second place, 9 is greater than 2. The amount of the error, therefore, does not include any unit of the second place. But the error reappears in the columns of units of the third place and of the fourth place. The error, therefore, includes a unit of the fourth place (1 000) and a unit of the fifth place (10 000).

The total will then be 11 010.

At the risk of becoming wearisome, we have dwelt at length on this example. We think it is important because it concerns a small problem of the type which is currently given to the young students of the fifth class and because it is well suited to highlight the educative value of the decimal system.

In addition to the study of whole numbers, the curriculum for arithmetic for the fifth class includes fractional numbers and, through them, the study of the quotient : exact quotient and approximate quotient, carried out one, two or three places. The child can this time acquire the concept of precision of a result and, again thanks to the decimal system, observe that a quotient can be calculated to any desired accuracy.

In Fourth and Third Classes (3 Hours per Week)

During the next two years the student familiarizes himself with more and more complex mathematical ideas, both in algebra and geometry. From the point of view of the decimal system, he will not be taught anything new. At the most, he will acquire a certain skill, thanks to the study of surfaces and volumes, in converting units : units of length to the power of 10, units of surface to the power of 100, units of volume to the power of 1 000.

In Second Class

We have now to discuss, not the curriculum for mathematics, but for physical sciences. The basic concepts acquired during the preceding year have been concerned with length, surface, volume, weight and time.

In studying the physical sciences (one hour per week), the student (who is now aged 15 or 16 years) will be getting acquainted with various new concepts and will learn what exactly is the difference between mass and weight. In broad outline the curriculum includes the study of gravity, force, work and power, the statics of fluids and heat.

The units of the *mks form* of the metric system with which he will be familiar at the end of the second class are, therefore :

Mass : kilogram

Force : newton (The force which gives a mass of one kilogram an acceleration of one metre per second per second).

Work (or energy) : joule (The work done when the point of application of one newton is displaced through a distance of one metre in the direction of the force).

Power : watt (The power required to produce energy equal to one joule per second).

Heat : kilocalorie (The quantity of heat necessary to raise the temperature of one kilogram of water from 14.5°C to 15.5°C). Incidentally, the Ninth General Conference of Weights & Measures in October 1948 has proposed the joule as the unit for the quantity of heat, in consideration of the fact that heat is only one of the forms of energy.

In First Class

In the first class, the curriculum for physics occupies two or two and one-quarter hours per week, depending on the section.

Three comprehensive subjects are included in the curriculum: electricity, magnetism and electromagnetism, optics.

Numerous units are, therefore, defined and taught during this year :

Intensity of current : ampere

Intensity of a constant current which, maintained in two parallel and rectilinear conductors of infinite length and negligible circular cross section which are located at a distance of one metre from each other in a vacuum, produces between these conductors a force equal to 2×10^{-7}

mks unit of force (i.e. newton) per one metre of length.

Difference of potential : volt

Difference of electric potential which exists between two points of a conductor carrying a constant current of one ampere, when the power dissipated between these points is equal to one watt.

Electric resistance : ohm

The electric resistance which exists between two points of a conductor when a constant difference of potential of one volt, applied between these two points, produces in the conductor a current of one ampere and the conductor is not the seat of any electromotive force.

Quantity of electricity : coulomb

Quantity of electricity transported in one second by a current of one ampere.

Magnetic flux : weber

The magnetic flux which, when traversing a single-loop circuit, produces therein an electromotive force of one volt if it is returned to zero in one second by uniform decrease.

Terminal Classes

After successfully passing the examination for the first part of the baccalaureate, the French student completes his secondary schooling by opting for some type of scientific specialization. The courses for physics and mathematics (3 hours) and experimental sciences (2-1/2 hours) classes enable him to broaden certain already familiar concepts and to become acquainted with some new units. Particularly in electricity, he will discover :

Electric capacitance : farad

Capacitance of an electric condenser in which a charge of one coulomb produces a difference of potential of one volt between the poles of the condenser.

Electric inductance : henry

Electric inductance of a closed circuit in which an electromotive force of one volt is produced when the electric current travelling through the circuit varies uniformly at the rate of one ampere per second.

In addition, the study of acoustics and optics introduces the student to new units of length : angstrom (10^{-10}m), the red band of cadmium (0.643 846 96 micron) as well as the different optical units : candela (luminous intensity), lumen (luminous flux), lux (illumination), diopter (power of an optical system with a focal distance of one metre).

With the termination of his secondary schooling, the French student has thus a complete practical experience of the metric system. He knows all its units. The numerous problems which he has solved, will have made him well versed in its different practical forms in use (*cgs*, *mts* and *mks*) and with the transformations necessary to change from one form to another. As he is initiated into the metric and decimal systems from his earliest childhood and having practised it almost daily for not less than 12 years, he will certainly not be conscious of the enormous difficulties which his forefathers encountered in daily life as well as in scientific pursuits before the metric system was invented.

Metric System—Origin, Advantages and Growth in the World

J.T. JOHNSON
President,
Metric Association,
USA

THE metric system of weights and measures originated in France, as most of you know, in the last decade of the 18th century, 1790 to 1799. Before 1790 there were in Europe more than 280 different kinds of measuring feet. The fact that each country and city had its own measuring foot soon became a great hindrance to commercial expansion. This led to France calling a meeting in 1790 to which delegates from the different countries of Europe were invited for the purpose of organizing a new system of measurements. Their debate lasted over a year. In March of 1791, a committee of the French Academy presented a report recommending that the length of a quadrant of the earth's circumference measured along a meridian be taken as the basis and, to make it of convenient length, that 1/10,000,000 of it be the unit of length to be called the 'metre'. This measurement was to be made between the city of Dunkirque on the north coast of France and Barcelona on the southern coast of Spain. This offered the greatest overland distance on a meridian in Eupore, about 9° and 30' and it extended on each side of the latitude 45° N. In June of the next year, Delambre and Mechain were entrusted with the surveying. In 1798 the surveying was finished. It was checked and was found to be remarkably accurate. On 22 June 1799, a platinum metre bar was finished and deposited in an underground vault near Sevres, a suburb of Paris. It is known as the 'Metre of the Archives'. It thus took seven years to make the first metre bar.

Growth—In Europe and USA

In 1840 the metric system was made compulsory in France. In 1870 the first Metric Congress was held in Paris. USA was represented there. As a result of it prototype metres and kilograms were made for different countries. In 1875, the permanent International Bureau of Weights and Measures was established on a plot of ground in the Park of St. Cloud just outside Paris. The United States is a member of this Bureau and sends delegates to its biennial meetings. The last one was held in October 1958. The use of the metric system grew rapidly among the various countries of Europe, South America and Asia until today its adoption is established in some 55 of the main 57 countries of the world.

The United States made the metric system permissible by an Act of Congress in 1866. The US Navy adopted it in 1878 for its medical department. In 1890 the US received its prototype metre No. 27 and prototype kilogram No. 20. These are at present kept in a subterranean vault of the National Bureau of Standards at Washington, D.C. In 1893 the metre was made the standard of length by an Act of Congress and the yard is now defined as 3600/3937 metres. In 1894 the War Department adopted the metric system for its medical work. In the same year it was adopted for all electrical work. In 1902 the United States Health Service adopted it. In 1907 the Philippine Islands legalised it. In 1922 the Amateur Athletic Association adopted it. In 1944 the

Council of Chemistry and Pharmacy of the American Medical Association adopted its exclusive use. The US Pharmacopoeia was rewritten in metric terms. In 1946 the State Department of the US Government recommended exclusive use of the metric system in international aviation. In 1957 Eli Lilly & Co. on their own initiative converted to metrics in pharmacy. The SAE Aeronautical Drafting Manual Committee lists 47 users of decimal dimensioning among the aircraft companies. This last decimal dimensioning is not full use of the metric system, however, and is an unfortunate and unfavourable act for the metric system. This trend towards decimalization is again manifested in that mechanics has decimalized the inch, engineering has decimalized the foot and aviation has decimalized the mile. The best that can be said for this is that it shows a desire for decimalization of which the metric system makes full use. It entrenches the trend towards metrics but at the same time, it postpones the conversion to the full use of the metric system.

Wars and the Metric System

It is interesting to note how major wars have affected progress in the metric movement. The metric system was inaugurated in France in 1799 right after the French Revolution. Its use was made permissive in the USA after agitation in 1866 just after the Civil War. After the Prussian Wars in Europe in 1871, Germany, Austria, Hungary and their dependent states adopted the metric system and thus almost doubled the then metric population. In 1920-21, after World War I, its use was made official in Russia, Japan, China and Turkey. That again more than doubled the metric population at that time. Now India has decimalized its coinage on 1 April 1957 and begun the metric change-over from 1 October 1958. The latter change will be completed by 1966. That will make the world about 90 percent metric. This is a trend that cannot be stayed.

Status in World Today

We are still in the post-war period of World War II. The present agitation and interest regarding the metric reform is being felt not only in the USA but in many other countries. The American Association for the Advancement of Science has appointed a Metric Committee for the first time in its history of 110 years. I happen to be a member of that Committee. Great Britain's Association which corresponds to our AAAS has also appointed a Metric Committee with which I am in constant touch. The Island of Cyprus has adopted decimal coinage. Australia is now engaged in a serious study of decimal coinage and is debating whether it is better to decimalize the pound or the shilling. New Zealand, South Africa and other British Commonwealth countries are also preparing for decimal coinage. When these countries become decimalized in their coinage they will be on their way towards full adoption of metrics, for the world is moving faster today than a generation ago. India is ahead of all these countries because it has already started the use of the metric system.

USA should be doing more than it is doing at the present time or it is entirely possible that there would be a British 'Metric Sputnik'. USA would then, of course, have to follow India, Australia and Great Britain after they have gone metric.

Advantages

For the benefit of those who may not be so familiar with the metric system and may think of it as a 'foreign system' because it originated in France, a brief statement of its advantages may be appropriate here. There must be something inherently more desirable in the metric system than in the English system or the steady trend in metric usage would be checked here and there. No nation has ever turned back after having adopted the metric system. That alone should be sufficient argument for the USA and England to cause them to take a serious attitude towards the metric question.

Briefly, the advantages of the metric

system are three. They are as follows :

1. *Simplicity*—When we compare *some 53 concepts* and terms in our English system of weights and measures, with which we are supposed to be familiar, with the *three simple terms : metre, litre and gram,* which constitute the metric system, this advantage is at once evident.

The following six statements comprise the commonly used units of the metric system :

For Length

10 millimetres (mm)	=	1 centimetre (cm)
100 centimetres (cm)	=	1 metre (m)
1000 metres (m)	=	1 kilometre (km)

For Capacity

1000 millilitres (ml)	=	1 litre (l)
or 1000 cubic centimetres (cm^3)	=	1 litre (l)

For Weight

1000 grams (g)	=	1 kilogram (kg)
1000 kilograms (kg)	=	1 metric tonne (t)

No other units are required for the layman in his expressions of metric quantities.

The whole metric system can be seen and envisaged from the metre stick.

2 *The One-To-One Correspondence Between The Metric System Units of Length, Capacity and Weight*—One cubic centimetre of water has *one* centimetre for its cubic dimension and weighs *one* gram. There is no such correspondence in the English system. One cubic foot of water weighs approximately $62\frac{1}{2}$ pounds. This correspondence effects a tremendous simplicity in computation. An illustration will throw more light on this.

Let it be required to find the weight of the water in a full tank that measures 4 feet by 3 feet 6 inches by 2 feet 4 inches.

The work required is shown here :

(i) 4
x$3\frac{1}{2}$
12
2
14

(ii) 14
x$2\frac{1}{3}$
28
$4\frac{2}{3}$
$32\frac{2}{3}$ cubic feet

(iii) $62\frac{1}{2}$
x$32\frac{2}{3}$
$16\frac{1}{3}$
124
186
$2000\frac{1}{3}$

(iv) 62
x$\frac{2}{3}$
3) 124
$41\frac{1}{3}$
+$2000\frac{1}{3}$
$2041\frac{2}{3}$ pounds=1 ton,
41 2/3 pounds.

The above requires as many as 75 figures and a knowledge of how to multiply with mixed numbers.

Let us compare a similar problem in the metric system:

Let us find the weight of water in a full tank that measures 4 metres by 3.6 metres by 2.4 metres.

The work required is shown here ;

(i) 3.6
x4
14.4

(ii) 14.4
x2.4
576
288
34.56 cubic metres=
34.56 metric tonnes

(Because 1 cubic metre of water weighs 1 metric tonne)

Only 25 figures are required and no knowledge of the rather intricate multiplication with mixed numbers.

3. *Decimal Division of its Units*—This is by far the greatest advantage the metric system has over the English. Such an advantage has already been adopted in that mechanics has decimalized the inch, engineering has decimalized the foot and aviation has decimalized the mile. But this partial implementation has reaped only a part of the full benefit of decimal division and decimal relation of units throughout and has served at best only as a hybrid of the full advantage of decimalization. Such action has only postponed the total adoption of metrics and thus has caused a continuance of the use of the inch, foot and mile with their non-decimal interrelation. The full advantage can be seen in another illustration.

Let it be required to reduce 23 miles,

297 rods, 3 yards, 2 feet and 9 inches to inches.

English Method

```
(i)     23 miles
      x320 (rods per mile)
       460
       69
      7360 rods
    + 297 rods
      7657 rods

(ii)  7657   rods
       x5.5  (yards per rod)
     38285
    38285
    42113.5  yards
       +3    yards
    42116.5

(iii)  42116.5    yards
          x3      (feet per yard)
      126349.5    feet
          +2      feet
      126351.5    feet

(iv)  126351.5   feet
          x12     (inches per foot)
       2527030
      1263515
      1516218.0    inches
            +9     inches
      1516227.0    inches
```

Metric Method

In a similar metric example, let it be required to reduce 23 kilometres, 978 metres, 86 centimetres, 9 millimetres to millimetres.

Here is the work required :

Just copy the figures and label answer.

23,978,869 millimetres.

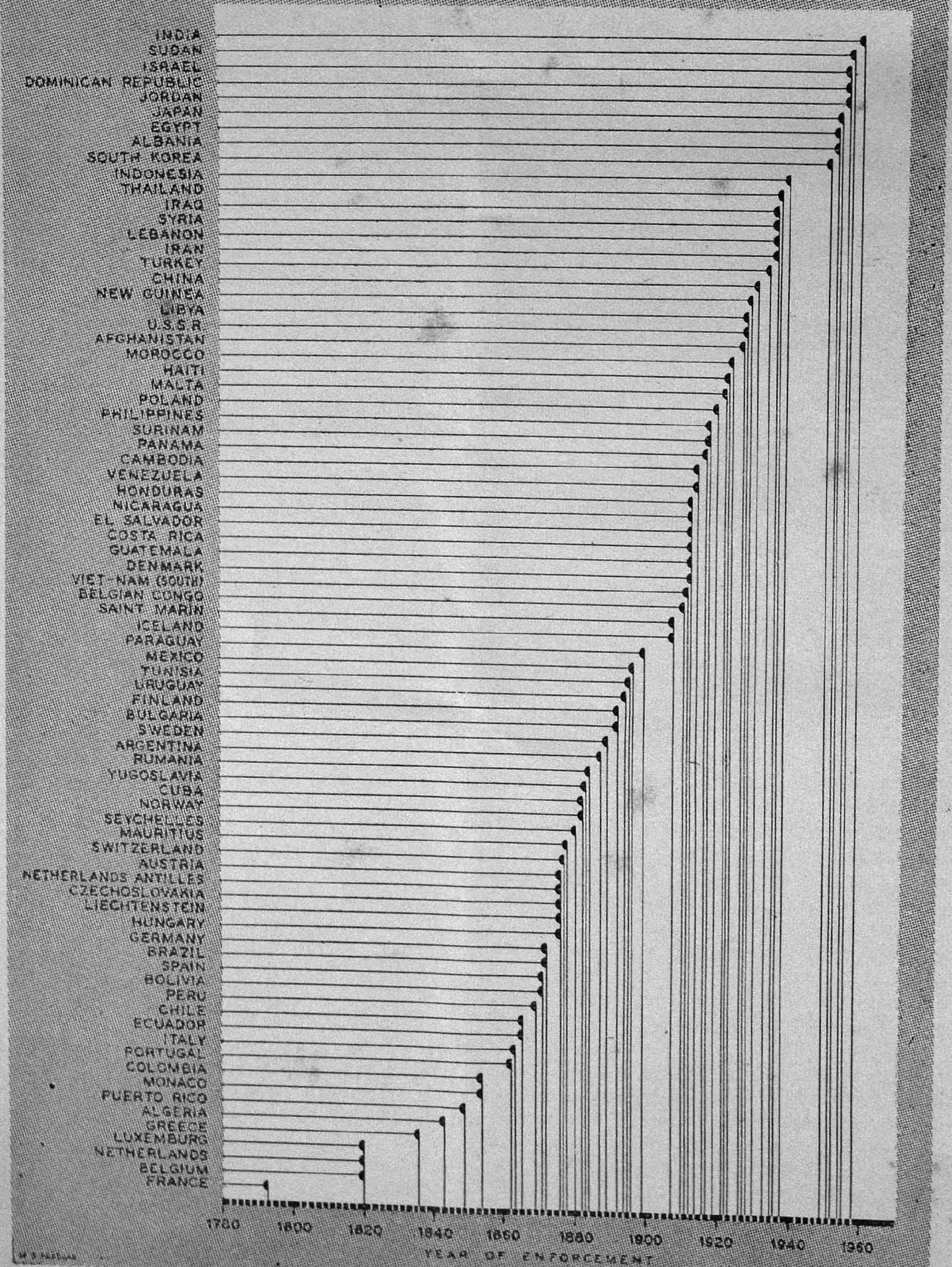
The time required here would be about 3 seconds in the metric system as compared with approximately 3 minutes using the English system. Some may criticize in that we seldom use such many-step reductions. This may be true, but we do use one-step reductions as, for example, feet and inches in house construction. To find floor space or cubic contents of houses, there may be need for such dimensions as 24 feet 4 inches by 32 feet 6 inches and 34 feet 6 inches by 28 feet 4 inches by 14 feet 3 inches. This latter reduces to 34 1/2 feet x 28 1/3 feet x 14 1/4 feet and will involve many steps and probable errors.

The big fundamental advantage underlying the logical reasoning for use of the metric system comes from the fact that our whole number system in all of its fundamental operations of addition, subtraction, multiplication and division plus the four fundamental operations in decimals plus all of the cases in percentage use the decimal procedure which is, of course, metric.

Here is what we have been doing for hundreds of years. We have used the decimal system in our whole number computation but in measuring lengths and in counting with groups we have used the duodecimal, e.g. 12″=1′ ; 12 things=1 dozen. In measuring other lengths again we have used the tertiary, e.g.. 3ft.=1yd. In measuring capacity we have used the binary and the quaternary 2 pints=1 quart ; 4 quarts=1 gallon ; 4 pecks=1 bushel. In measuring weights we have used the sexadecimal, e.g. 16 oz = 1 lb. Here comes the metric system and reduces all these various systems to one system and that system right in line with our whole number system. What more do we want ?

A final comment should be added in that French, German and Russian children use the metric method and thus have an unfair advantage over children in the USA.

ADVANCE OF METRIC USAGE IN THE WORLD



NOTE—METRIC SYSTEM IS COMPULSORY IN ALL TERRITORIES OF FRENCH EQUATORIAL AFRICA, FRENCH WEST AFRICA AND IN MOST PORTUGUESE AND SPANISH POSSESSIONS.

Change-over in Indian Sugar Industry

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TO adopt the metric system is to line up with progress in science and industry. Based as it is on the decimal system it is a step towards simplification. Incidentally it provides an opportunity for the standardization of weights and measures all over the country.

To effect the change, however, is not easy. It means a crusade against the ingrained habits of centuries. Nevertheless the change is unavoidable and the sooner it is effected the better for all concerned.

The Indian sugar industry has reacted to this reform very favourably. Soon after the Indian Parliament passed the Standards of Weights and Measures Act, 1956, the Development Council for Sugar Industry met to find ways and means of adopting the metric system in the sugar industry. It was decided to draw up a phased programme for a smooth change-over. An expert committee was asked to go into the question in necessary detail.

First deliberations of this committee have brought out encouraging possibilities of an early change-over without much difficulty. Except a few sections relating to engineering and workshop practice, the change can be effected quite expeditiously.

In the sugar industry, measurement of length, mass, time, temperature or pressure is involved mainly at the following stages:

(1) In the purchase of machinery, its spare and replacement parts and other engineering stores like steel, cement, oils, paints and hardware goods.

(2) In the purchase of the raw material—sugarcane.

(3) In factory control during the milling of cane, processing of juice and generation of steam and in the laboratory for analytical purposes.

(4) In the packing and sale of sugar and by-products like bagasse, press-mud and molasses.

Let us examine the possibilities of the change-over to the metric system at each of the above stages.

Purchase of Machinery and Spare Parts

Sugar factory machiney has been and is being purchased from European countries, namely, Great Britain, France, Germany, Holland, Czechoslovakia and Italy. The specifications of the British machinery are in the British units while those of the Continental makes are in metric units. The position thus is that there is no difficulty regarding the fabrication of machinery parts and fittings in respect of the Continental machinery as it is already in metric units but considerable difficulty may be experienced in respect of British machinery. It will take some time before the use of British units can be given up. Engineering stores of both the British and metric specifications will have to be stocked for a long time which will involve considerable investment. The difficulty is that

in mechanical engineering where mating parts are concerned, the standards of mating parts, as for example, studs, pipes and pipe flanges, standard keyways etc., are as a rule quite different for the two systems; mere arithmetical conversion of one system to another does not meet the purpose. The mating parts will have to continue to be expressed in the original system till their economical life is over.

Purchase of Raw Materials, Chemicals and Other Stores

Sugarcane, limestone, lime, coke, sulphur, superphosphate, caustic soda, hydrochloric acid, coal, wood, lubricants etc. are purchased in terms of tons, hundredweights, maunds, pounds, gallons etc. The transactions regarding the sale or purchase of these articles will now have to be carried out in terms of corresponding metric units, that is, metric tonnes, kilograms, grams and litres. For purposes of measurement all weighbridges, scales, platform scales and balances will have to be in metric units. It has been decided that the necessary conversion of the weighing scales, balances etc. from the British to metric units should be undertaken from the season 1959-60. For the time being only the records may be kept in metric units with the help of conversion tables and ready reckoners so that people concerned may become used to these new units. As our currency is now based on the decimal system, calculation of prices for the commodities purchased in metric units will become extremely simple.

Some articles like gunny bags and filtercloth are at present being made and specified by the jute and textile mills in British units such as yards, feet and inches. These mills will now have to adopt metric specifications.

Control of Unit Operations and Laboratory Work

Most of the measuring instruments like thermometers, pressure and vacuum gauges are calibrated in British units, like the Fahrenheit scale for temperature, pounds per square inch for pressure and inches of mercury for vacuum. The dials of all these instruments will either have to be recalibrated to the metric system or new instruments marked in the latter system purchased. Till such time as complete change-over in this respect does not take place, at least all records can be kept in the corresponding metric units with the help of conversion tables. As the persons concerned with the recording and maintenance of these technical data will all be educated men, there should not be any difficulty in maintaining the records in metric units with almost immediate effect. Almost all laboratory measurements and records are already in metric units. The few items in laboratory work that are not being specified in metric units can be specified as such immediately.

Packing and Sale of Sugar and Other By-products

Sugar is at present packed in jute bags 44 x 26½ in. which contain 2 maunds and 30 seers of sugar. It has been decided now to pack 100 kilos of sugar. This is about 2 maunds and 27 seers. The present dimensions of the jute bags will be somewhat bigger than necessary for packing 100 kilograms. In due course the jute mills can modify the dimensions of the bag suitably.

Bagasse, press-mud and molasses are sold by weight and the problem here is one of general conversion of the weighbridge and platform scales and other balances.

Implementation

Steps in the above direction are proposed to be taken with effect from the crushing season 1959-60.

The sugar industry, like any other industry, will have to deal with both the educated as well as the uneducated public and public undertakings like the Railways. The speed with which the change-over takes place in the sugar industry will depend upon the speed with which the general public and the public undertakings adopt the metric system.

Considerable propaganda and education in this regard will be necessary and if this goes according to plan, I should hope that the change-over in the sugar industry will be effected well within the prescribed time limit.

* *

BSI Adopts International Paper Sizes

THE British Standards Institution, (BSI), starting from March 1958, has introduced changes in the sizes of paper used by it with a view to bring these sizes into line with general international usage. To begin with the changes were effected in the bulk of stencilled documents produced inside British Standards House ; but within two to three months the new sizes were extended to most stationery and from July 1958 to the BSI publication, 'BSI News'. It was explained that the change-over was not made all at once, because existing stocks of paper had to be used up before the change could be fully effected.

The February 1958 issue of 'BSI News' explained : 'This change is not standardization merely for the sake of it. For some time BSI in common with a number of large commercial organizations, has used what are termed 'international' paper sizes in some of its overseas correspondence. Obviously, from BSI's point of view—as indeed from that of commercial firms—it will be economical to standardize on its paper stocks for both home and overseas use.

'But more important than this immediate domestic economy are a number of longer term implications.

'The two best-known international paper sizes are A4 measuring 210 mm by 297mm (approximately 8¼ in. x 11¾ in.) which falls conveniently between the conventional 'foolscap' and 'quarto' letter paper—both of which it replaces, and A5 which is exactly half the size of A4.

'These and related sizes in the 'A' series were accepted by many countries before the last war and are now standard in at least 26. It is expected that the 'A' range will be included in world recommendations by ISO (the International Organization for Standardization). Commonwealth countries at the Delhi standards conference last year also agreed to change as soon as was practicable to the 'A' series.

'The importance to Britain of foreign trade and such developments as the proposed European Free Trade Area, make it increasingly necessary that our practices should, wherever possible, be in line with those of other countries.

'BSI hopes that its change to the 'A' series of paper sizes will encourage industry and commerce to follow suit; the eventual results could be of wide benefit to paper manufacturers, to printers and to all paper users—not least the girl in Stockholm or Sheffield whose job includes filing.'

It was reported that many sections of industry—and especially those concerned with providing information for architects and others in the building field—are following BSI's lead and adopting the international 'A' series of sizes for both correspondence and literature.

*Survey of Weights & Measures in Manufacturing Industries**

THE Standards of Weights and Measures Act, 1956, (89 of 1956), provides for the gradual introduction of the metric system in weights and measures in all sectors of the economy over a period of ten years. With a view to assessing the prospective demand for the new physical weights and measures over these years the Standing Metric Committee desired that an approximate estimate of the existing weights and measures which are likely to be replaced by the metric system should be furnished to them. On the basis of such assessment the Committee could devise steps for the manufacture of metric weights and measures in the limited period of the next few years.

The Proposal and Subsequent Arrangements

The Standing Metric Committee suggested that a sample survey might be organized through the agency of the National Sample Survey Organization (NSS). In June 1956, the Indian Statistical Institute was requested to provide a design for the purpose. This was followed up in the next month by a technical discussion about the exact requirements and arrangements. It was agreed that the survey should be integrated with the current socio-economic household surveys and the Sample Survey of Manufacturing Industries of the NSS. All technical arrangements were completed before August 1956 but the survey in the manufacturing sector could not start before the middle of January next due to inadequate staff.

In view of the urgency of the estimates, processing of the data was given special priority in order to enable the Institute to furnish the information within eight weeks of the receipt of the last batch of completed schedules.

The survey was completed by the middle of July 1957 and the last batch of completed schedules were received in the Institute by the middle of August and broad results of the survey, both in the manufacturing and other sectors, were made available to the Government of India in October 1957. This article contains results relating to the manufacturing sector. It may be observed that the statistics presented in the accompanying Tables cover weights and measures used in factories only. They constitute probably not more than one percent of the weights and measures used for all purposes in the country.

Coverage and Scope

Weights and measures which would require replacement consequent on the introduction of metric system were covered by this survey.

Data were collected from manufacturing establishments sampled for purposes of the fifth round of Sample Survey of Manufacturing Industries. The survey covered all manufacturing establishments in India including Jammu and Kashmir, registered under sections 2m(i) and 2m(ii) of the Factories Act, 1948, which states :

(m) "factory" means any premises including the precincts thereof :—

(i) whereon ten or more workers are working, or were working on any day of the

*Contribution from the Indian Statistical Institute, Calcutta

preceding twelve months, and in any part of which a manufacturing process is being carried on with the aid of power, or is ordinarily so carried on, or

(ii) whereon twenty or more workers are working, or were working, on any day of the preceding twelve months, and in any part of which a manufacturing process is being carried on without the aid of power, or is ordinarily so carried on :—

but does not include a mine subject to the operation of the Mines Act, 1952 (XXXV of 1952), or a railway running shed;

The establishments under the control of Ministries of Railways and Defence were, however, excluded from the scope of the survey.

Sampling Design

The frame for sampling of establishments was prepared on the basis of lists obtained from the registers maintained in the offices of the Chief Inspectors of Factories of the various States. It was found that for India as a whole there were altogether 32,756 factories in the frame for this survey, out of which 26,676 were registered under section 2m(i) of the Indian Factories Act 1948, and 6,080 under 2m(ii) of that Act.

The design was one of stratified random sampling. Industry categories, 63 in number according to the Census of Manufacturing Industries Rules, 1945, constituted the primary strata. These again were further stratified to groups of establishments, broadly ensuring equality in the number of workers employed.

Allocation of the number of sample units was made on the joint considerations of number of workers and variability of output per worker. The total number of sample establishments was 4,026.

The collection of data referred to the point of time when the investigator visited the factory.

Schedule

The survey included information on the systems of weights and measures, their ratio to a standard system, the material of which the weights and measures were made and the number of pieces possessed by an establishment. Three major systems i.e. weight, capacity and length, had been further subdivided. Thus weights system was subdivided into the seer and the pound systems of weights; capacity measures were further subdivided into the gallon and seer. The length system was surveyed only for the foot system.

It was considered desirable that in the manufacturing industries we should try to collect information on weighing devices like spring balances and weighbridges which were supposed to be extensively used in factories. It was with this intention of giving a perspective of weights systems that information on weighing machines had been collected.

Some Specifications

Tabulation was made with breakdowns for specified denomination groups, with further breakdown of material used.

Response and Results

Data could not be collected for 156 sample establishments. This brought the effective sample size down to 3,870. About 6 percent of these sample establishments reported that they were not using weights or measures due to the nature of their activity e.g., book-binding, repairing workshops, studios and the like; some of these might be real cases of non-response.

In the subsequent paragraphs an attempt has been made to indicate the broad results of analysis of the data collected from the manufacturing sector.

Table 1 shows that in the manufacturing industries the total number of pieces of weights of all denominations is about 4 lakh 28 thousand divided almost equally between the seer and the pound systems. Besides, the factories use over 42 thousand weighing machines of different capacity. Capacity gallon and seer systems account for about 17 thousand and 9 thousand

respectively. In the length measures the number of pieces of foot measures is 1 lakh 11 thousand.

TABLE 1—ESTIMATED NUMBER OF PIECES OF WEIGHTS, WEIGHING DEVICES, CAPACITY AND LENGTH MEASURES.

Sl. No.	System	No. (in thousand)
1	Weights—Seer	218.40
2	Weights—Pound	209.99
3	**Total**	428.39
4	Weighing machines	42.66
5	Capacity—gallon	16.91
6	Capacity—seer	8.89
7	Length—foot	111.03
8	Size of sample	3,870
9	Size of universe	32,756

Tables 2 and 3 show that weights of the highest denomination group i.e. above 5 seers and above 10 pounds constitute the bulk for all factories. In the seer system this highest denomination group forms about 36 percent and in the pound system 43 percent. Next in importance is the lowest denomination group, i.e., below 0.25 seer and 0.5 pound which accounts for about 22 percent and 19 percent for the seer and the pound systems respectively. Weights upto 0.50 seers and upto 1 lb constitute about 37 percent and 35 percent respectively. Again, highest and lowest denomination groups together account for 58 percent for the seer system and 62 percent for the pound system.

Again, Tables 2 and 3 show that cast iron weights are highest in use in all the denomination groups except those below 0.25 seers and 0.5 pound where the number of brass weights is highest. Cast iron weights form nearly 82 percent in both the systems of weights. Next in importance are brass weights which account for about 12 percent and 14 percent of the number of pieces of weights under seer and pound systems respectively.

TABLE 2—DISTRIBUTION OF NUMBER OF PIECES OF SEER WEIGHTS BY MATERIAL AND DENOMINATION GROUP FOR ALL FACTORIES WITH THEIR PERCENTAGES.

Sl. No.	Denomination Group in Seers		Number (in thousand) Material: Cast Iron	Brass	Others	Total	Percentage to total
1	Below	0.25	20,67	22.42	3.88	46.97	21.51
2	Above	0.25—0.50	27.91	2.56	2.92	33.39	15.28
3	Above	0.50—1.00	19.57	0.33	1.73	21.63	9.90
4	Above	1.00—2.00	9.70	0.21	1.12	11.03	5.05
5	Above	2.00—5.00	24.65	0.24	1.26	26.15	11.98
6	Above	5.00	75.20	0.26	3.77	79.23	36.28
7	**Total**		177.70	26.02	14.68	218.40	100.00
8	Percentage to total		81.37	11.91	6.72	100.00	

TABLE 3—DISTRIBUTION OF NUMBER OF PIECES OF POUND WEIGHTS BY MATERIAL AND DENOMINATION GROUP FOR ALL FACTORIES WITH THEIR PERCENTAGES

Sl. No.	Denomination Group in Pounds	Number (in thousand) Material				Percentage to Total
		Cast Iron	Brass	Others	Total	
1	Below 0.5	14.61	23.63	1.49	39.73	18.92
2	From 0.5—1.0	26.71	2.26	4.42	33.39	15.89
3	From 1.0—2.0	15.49	0.50	0.29	16.28	7.75
4	From 2.0—5.0	15.37	0.28	0.31	15.96	7.60
5	From 5.0—10.0	14.64	0.20	0.30	15.14	7.20
6	Above 10.0	85.49	2.00	2.00	89.49	42.64
7	**Total**	172.31	28.87	8.81	209.99	100.00
8	Percentage to total	82.07	13.75	4.18	100.00	

TABLE 4—DISTRIBUTION OF WEIGHING MACHINES BY MAXIMUM CAPACITY GROUP WITH PERCENTAGE TO TOTAL FOR ALL FACTORIES.

Sl. No.	Capacity of Weighing Machine in maunds	No. (in thousand)	Percentage to total
1	Upto 2.00	12.11	28.39
2	Above 2.00—7.00	10.51	24.64
3	Above 7.00—28.00	13.69	32.09
4	Above 28.00—140.00	2.60	6.09
5	Above 140.00	3.75	8.79
6	**Total**	42.66	100.00
7	No. of sample factories	3,870	—

Table 4 shows the distribution of weighing machines by capacity groups. The weighing machines include spring balances, platform weighing machines, weighbridges, automatic weighing machines etc. In this Table the capacity of weighing devices having calibration either exclusively in seer system or exclusively in pound system or having calibration in both the systems has been expressed in standard maunds. Weighing machines with capacity between 7 maunds and 28 maunds are highest in use, being 32 percent of the total number.

TABLE 5—DISTRIBUTION OF NUMBER OF PIECES OF GALLON MEASURES BY DENOMINATION GROUP WITH PERCENTAGE TO THE TOTAL OF ALL DENOMINATIONS FOR ALL FACTORIES

Sl. No.	Denomination Group in Gallon		No. (in thousand)	Percentage to Total
1	Below	0.25	5.29	31.29
2	From	0.25—.50	2.63	15.55
3	Above	0.50—1.00	2.62	15.49
4	Above	1.00	6.37	37.67
5	**Total**		16.91	100.00
6	No. of sample factories		3,870	—

In Table 5 volumetric capacity measures in ounce, pound, gallon system have been expressed as gallon and number of pieces of such measures has been given for different denomination group with percentage distribution. The highest denomination group i.e., above 1 gallon constitutes about 38 percent followed by lowest denomination group which is 31 percent of the total.

TABLE 6—DISTRIBUTION OF NUMBER OF PIECES OF CAPACITY MEASURES IN SEER BY DENOMINATION GROUP WITH PERCENTAGE FOR ALL FACTORIES

Sl. No.	Denomination Group in Seers		No. (in thousand)	Percentage to Total
1	Below	0.5	1.55	17.43
2	Above	0.5—1.0	4.87	54.78
3	Above	1.0—2.0	0.27	3.04
4	Above	2.0—5.0	0.12	1.35
5	Above	5.0	2.08	23.40
6	**Total**		8.89	100.00
7	No. of sample factories		3,870	—

Table 6 shows capacity measures in seer system. Seer capacity measures of the denomination group between 0.5 and 1.0 constitute about 55 percent of the total.

TABLE 7—DISTRIBUTION OF THE NUMBER OF FOOT MEASURES BY DENOMINATION GROUP WITH PERCENTAGE TO THE TOTAL OF ALL DENOMINATIONS FOR ALL FACTORIES

Sl. No.	Denomination Group in Feet	No. (in thousand)	Percentage to Total
1	Below 0.5	0.94	0.85
2	Above 0.5—1.0	41.25	37.15
3	Above 1.0—3.0	37.93	34.16
4	Above 3.0—20.0	13.02	11.73
5	Above 20.0	17.89	16.11
6	**Total**	111.03	100.00
7	No. of sample factories	3,870	—

Table 7 shows distribution of number of pieces of foot measures of the length system by denomination group. Foot system of the denomination group between 0.5 and 1.0 forms 37 percent followed by denomination group between 1.0 and 3.0 which is 34 percent of the total.

TABLE 8—DISTRIBUTION OF THE NUMBER OF PIECES UNDER DIFFERENT SYSTEMS IN FACTORIES WITH PERCENTAGE AND AVERAGE

Sl. No.	System	Estimated No. of Factories	Percentage of Factories to Total Factories	No. of pieces	Average No.
1.	Weight system on seers in				
	(a) Factories using exclusively seer weights	7,125	21.75	1,35,249	18.98
	(a) Factories using both pound and seer systems	4,904	14.97	83,151	16.96
	Total	12,029	36.72	2,18,400	18.16
2.	Weight system on pound in				
	(a) Factories using exclusively pound weights	7,276	22.21	1,07,616	14.79
	(b) Factories using both pound and seer systems	4,904	14.97	1,02,377	20.88
	Total	12,180	37.18	2,09,993	17.24
3.	Weighing devices	11,196	34.18	42,660	3.81
4.	(a) Capacity measures in gallon system	3,011	9.19	16,910	5.62
	(b) Capacity measures in seer system	1,143	3.49	8,890	7.77
5.	Length measures in foot system	12,099	36.94	1,10,360	9.12
	Total no. of factories	32,756	—	—	—

Table 8 shows that pieces of weights under both seer and pound systems are used by nearly 60 percent of the factories. The Table shows that not only from the standpoint of number but also from that of use, the pound system and the seer system are equally popular. Each system is used by about 37 percent of the factories. The average number per factory using the system is about 18 under both the systems.

Weighing devices, i.e. weighbridges, spring balances, platform scales etc., are used by about 34 percent of the factories and the average number per factory using them is 4. Capacity gallon system and the seer system are used by over 9 and 3 percent of the factories, respectively and the average number under both the systems is about 6 and 8 respectively. Foot measures are used by about 37 percent of the factories, each factory having over 9 pieces of foot measures on the average.

* * *

The Union Public Service Commission has announced that with effect from 1960 the papers on arithmetic and mensuration for every examination for which these are the prescribed subjects, may include questions on the metric system of weights and measures.

* * *

The 'Metric System Stall' has been attracting considerable attention. As the stall is of educative value it is proposed to be made a permanent feature of 'India 1958 Exhibition', a part of which is likely to be converted into a permanent exhibition. It is understood that the exhibition would be displaying commodities exported by India, the industrial projects, progress in science and various development schemes which have a public educative value.

* * *

The metric system is being used in the quotation of the minimum price for sugarcane for the season 1958-59 by the Department of Food of the Ministry of Food and Agriculture. According to one of their latest announcements the minimum price for sugar cane has been fixed at Rs. 1.44 per maund or Rs. 3.85 per quintal, where the sugarcane is delivered at the gate of the factory or any other purchasing centre connected by road. The price of sugarcane delivered at any purchasing centre connected by rail has been fixed at Rs. 1.31 per maund or Rs. 3.50 per quintal. The announcement also indicates the rebate per maund or per quintal.

Reactions to Metric Reform

M.L. MADAN
Ministry of Commerce & Industry,
New Delhi

IN the middle of this year it became known that a National Exhibition to be called 'India 1958' was being planned to be held in October 1958 to synchronize with the IMF and World Bank meetings. The date was a rare coincidence as the metric reform was also to begin in October 1958 and it was a natural corollary that the metric system should be given due publicity in 'India 1958'. What should be displayed and how? The subject could be simplified or technically explained. Being the initial attempt, the emphasis was to be on showing the variety of old weights and measures and the uniformity and ease of operation of new metric weights and measures. Within 3 months quite a few sets of various types of weights and measures were collected from all over India, and the States of Andhra Pradesh, Assam, Bombay, Madras, Mysore, Rajasthan and West Bengal and Territories of Pondicherry and Tripura contributed largely to this collection which was enough to give an indication to the general public of the present chaos in this field. The new standard metric weights and measures emphasized the contrast between the old chaos and the new uniformity. The Indo French Society also desired to display French weights and measures as a matter of information for the general public.

The weighbridge, platform machines, person weighing machines (marked in kilograms and pounds, kilograms and maunds and kilograms and stones) were helpful in acquainting the people with the new names of metric weights and their equivalents without help from others. It may be said that there was not a single adult or child visitor who did not weigh himself (free of cost) on one of the machines.

The charts, tables and maps were of value in giving the public an idea of the extent of change-over. Other pictures depicting the metric countries of the world and showing how its adoption would help India went well with the public.

Visitors' Reactions

The documentary film on metric system, both in English and Hindi, was shown to the public seven times a day and about 21,000 had seen the film upto 30 November 1958 after which it was discontinued because of the intense cold in the open.

Conversion tables in Hindi and English were distributed freely, and nearly 1 lakh copies were distributed by 31 December 1958. It is estimated that more than 4½ lakh visitors had come to 'the Metric System' stall upto 31 December 1958.

The visitors, among whom were peasants and professors, primary school children and white haired old men, women and girls, asked innumerable questions. Many visitors were so curious that they discussed the pros and cons of the reform, implementation programme, international nomenclature and other topics.

Our participation in the Exhibition has proved of two-fold value: (1) It gave an opportunity to the general public to learn the metric system and to appre-

ciate the need for the reform. (2) It has given a general picture of the problems which are agitating the people, and their fears during the change-over period. It would be interesting to examine the main topics discussed.

Nomenclature

Generally, the first reaction of the public was that instead of adopting international nomenclature there should be a naya seer or some other Hindi name. There was no difficulty in convincing the public about the desirability of retaining international nomenclature. The main arguments which were effective were that the naya paisa case could not be applied to weights and measures because a whole new system of names would have to be devised for weights and not just one term as in decimal coinage. The adoption of naya seer for the kilogram would only add to the prevalent chaos. The visitors were convinced when they were told that if we derived any Hindi names, the problem would not be solved because the derived names would also be as new as the international names and may perhaps be more lengthy and difficult to pronounce. The question thus appears to be a matter of publicity rather than change of nomenclature.

Publicity Programme

The apparent lack of publicity was the target of criticism by many. The general opinion was that very little had been done in this respect compared to the publicity for decimal currency. Secondly, whatever had been done was only for the educated people and not for the illiterate people like labourers and peasants. The argument further ran that to be acquainted with new weights did not mean just knowing their names, their multiples and submultiples and theoretically knowing their mass in terms of the old weights.

The reply was that the change-over in the metric system would be gradual and had just started in some selected areas and not in the whole country as was done in the case of decimal currency. Adequate steps regarding publicity had already been taken in the areas where the system was being introduced and actual weights were demonstrated and people encouraged to handle them. It was suggested by some that for acquainting the illiterate labourers and peasants, special pictorial conversion tables of metric weights into prevalent weights should be issued !

Checking of Frauds

The fear was expressed by many that during the transition period people who may not recognize the new weights may be cheated by the traders and shopkeepers by charging them for kilogram while actually giving a seer of commodity. Many people felt that if the traders and shopkeepers were prevailed upon to use metric weights, they may refrain from using old weights and that would avoid frauds.

Conversion Problems

Many people felt that conversion problems similar to those faced in decimal currency would arise more frequently in the change-over for weights, especially during the two-year transition period. What was worse was that a single set of conversion tables would not suit all requirements because the accuracy of weighing, for example, gold and rice differed considerably. What the questioners did not realise was that the conversion problem existed in an acute form even now. How are the people dealing with transactions made in some 150 varieties of weights? Nobody is provided with conversion tables. The pound and seer conversion is a daily routine for many commodities. Even a villager has to deal with this. Fortunately, after two years or so, this type of odd conversion problem would be a thing of the past.

The solution to these interim problems was that the public should ask for commodities to be weighed either in the old units or the new. That meant it was more a matter of conversion of price per seer to price per kilogram and so on, which was a comparatively simple matter. There should be no mixing up of units as in decimal coinage. It would be ridiculous,

for example, to demand 58 grams of, say, rice instead of 1 chhataak. Better to buy 50 grams or 1 chhataak. This was because there was a 50 gram weight which could be used readily instead of 1 chhataak. This procedure would also simplify calculations. The simplest way was to think in metric units.

Lighter Moments

All was not, however, serious questioning. There were lighter moments as when a person inserted a 10 nP coin in the automatic person weighing machine and got a card showing his weight to be zero kilograms. He had forgotten to stand on the platform !

Another time while explaining the Centigrade thermometer and pipettes in the Indo French Society Section, a child's awed voice asked the demonstrator, 'Are you a doctor?'

A third was when a scientifically inclined visitor shocked his friend by asserting that one kilowatt was equal to 86 tolas. Of course, he meant a kilogram but confused his units. A live wire person indeed !

The 'Metric System Stall' has proved popular and it may safely be predicted from the reactions of the visitors that the large mass of people, many of whom were villagers, is actually eager for this reform and wish that it could be brought about in the quickest possible time.

Metric Conversion & ISI Convention

THE fourth Indian Standards Convention was inaugurated by Prime Minister Nehru on 24 November 1958 at Manak Bhavan, New Delhi, the new headquarters of the Indian Standards Institution.

On 25 November 1958, the entire day was devoted to a Session on 'Metric Conversion.' There were in all 8 papers for discussion and most of them dealt with the engineering and allied problems of conversion arising out of the change-over to the metric system.

Chairman's Remarks

Shri K.V. Venkatachalam, Joint Secretary, Ministry of Commerce and Industry, who was the Chairman of the Session, said in his opening remarks that the ISI had played a positive role in the reform of weights and measures, which was now in progress. It had given valuable advice in drafting legislation on weights and measures for the Parliament and the State Legislatures, and had published specifications for commercial weights, measures of length and capacity, and weighing machines of various kinds. It had helped in preparing specifications for Inspectors' standards and balances. It had published a number of metric standards including those on steel sections, steel and metallic products, building materials and components, and other important subjects.

He added that between preparation of a standard and its use in industry a time lag was involved and since the metric system was to be adopted fully in the country by December 1966, i.e. within 8 years, there was a pressing need to finalize the remaining standards quickly.

India's decision to adopt the metric system was viewed with satisfaction in metric countries, he continued. In the UK, the Commonwealth countries and the USA, it was acclaimed as a bold and imaginative decision and one which accorded with the lasting interests of India. In

the comments from the UK could be detected an undertone of regret that it had to continue to use a cumbrous system. He pointed out that even at this stage when the cost of change-over would be very high, there were influential bodies working for the change-over in the UK. South Africa was considering the adoption of decimal coinage and in the USA, its Metric Association was creating public interest in the metric reform.

He said that fears of the UK, USA and the Commonwealth countries about the future of their trade with India were groundless. India had assured them that they would continue to receive goods packed and invoiced in the manner they have been accustomed to.

He pointed out that in view of the introduction of metric weights from 1 October 1958, the immediate task was to bring weights and measures into actual use in the notified fields. The two important pre-requisites for their use in trade and industry were an adequate supply of commercial weights and measures, and facilities for recalibration of weighing instruments.

The manufacture of weights and measures was licenced by State Governments under State Weights and Measures (Enforcement) Acts. Large scale manufacture could begin within 2 or 3 months when the States had enacted legislation, rules, licenced factories and provided facilities for verifying and certifying weights and measures.

He pointed out that the conversion of weighing machines was a relatively simple process and most of the components necessary could be made in India. Some imports would be necessary to secure speedy conversion, but in view of the present difficulties of foreign exchange imports had to be restricted to the indispensable minimum. He hoped that manufacturers and repairers would consider it a duty and an opportunity to contribute to this task without making large demands for foreign exchange.

He remarked that there had been some criticism about the exclusion of P & T, Excise and Customs, and Railways from the first phase, although trade and industry in the private sector were urged to adopt the new system speedily. He stressed that the trade and industry were under no compulsion to adopt it until 1 October 1960. The intention was to have a period of transition during which trade could gradually change over, each particular unit adapting the speed of change-over to its special problems. The transition period would also enable the public to familiarize themselves with the new metric concepts. By the middle of 1960 many of the Government departments and public undertakings would have gone over completely to the metric system without any transition period. In view of their wide contact with the public, it would have caused much inconvenience to the public if they had adopted the metric system before the public had acquired reasonable familiarity with it.

The Chairman felt that the fears that there would be confusion and dislocation of trade in the areas adjoining those notified were baseless. The critics ignored that quite a number of systems now existed even in the same area, and the situation should be no worse than it was now. Adoption of the metric system on one particular date throughout the country was quite impracticable as it would only cause utter confusion and hardship. For example, would manufacturers hold over crores of weights and measures in anticipation of future demand ? They would have neither the storage space nor the financial resources for the purpose.

He emphasized that the Government by itself could not achieve much except with the co-operation of the public, particularly organized trade and industry and the professions, especially the engineering profession. He suggested that each individual factory, production unit, trading concern, etc. should set up its own study group which should examine the problems involved in the change-over and draw up a suitable programme. There were study groups already function-

ing for the engineering, jute and cotton textiles and tea industries.

Concluding, he said that teaching of arithmetic and sciences from the primary classes upwards would have to be reoriented towards the metric concepts. At the other end, the professional schools and colleges, polytechnics, etc. would have to take steps immediately to introduce training in the theory and practice of the metric system. An immediate beginning in the educational sphere was very necessary and new textbooks would have to be published early.

Dr. Lal C. Verman, Director, ISI, then gave a summary of the work done by ISI in preparing standards in metric system. After the Secretary, Shri T. Purnanandam, had given a brief resume of the papers, they were thrown open for discussion.

Discussion

The first two papers were two Indian Standards on the interconversion of units from one system of weights and measures into another. It was the general opinion that these two standards would serve where conversion problems were to be handled and interchangeability of components had to be ensured after such conversion.

The view was also voiced that in many cases mere conversion would not meet the requirements. It would be necessary to design components in metric units using rationalized metric dimensions. After the minimum of transition period, it would be desirable to think in metric units, work with metric units and execute jobs in metric units. This was typified by the standards on building materials and components in which the concept of modular co-ordination had been logically applied, using a module of 10 cm. The engineers, it was said, should get themselves acquainted quickly with these new concepts and use them so as to avoid a protracted transition period.

A novel suggestion was that in all drafting studios, the walls, floors, windows, doors, sills, beams etc, should be marked in metric units so that perception of metric measurements would be facilitated by constant observation. Another practical view was that it was also necessary to ensure 'interchangeability of understanding' in engineering drawings. For this purpose it may be necessary to devise a system to indicate the accuracy expected from any dimension mentioned on a drawing. This matter would be put before the appropriate Sectional Committee of the ISI.

The conversion of weighing machines also came under discussion. It was agreed that such conversion was not a difficult process. In one of the papers it had been suggested that the printed dials of weighing machines may have to be imported as adequate and accurate photo printing facilities were not available in India. The view was expressed that facilities for such work did exist in India and accurate work could be done as required for these dials.

In summing up the Chairman said that the discussions had been fruitful in bringing out the problems that were being faced and in seeking solutions for them.

With a vote of thanks to the Chair, the Session concluded at about 5.30 p.m.

Standards News

(Indian Standards which have a particular bearing on the change-over to the metric system are indicated here. Copies would be available from the Indian Standards Institution, Manak Bhawan, 9 Mathura Road, New Delhi or their branch offices at Bombay, Calcutta and Madras)

System of Screw Threads

A decision of far-reaching importance to the Indian engineering industry was taken on Saturday, 29 November 1958 at New Delhi when the Engineering Division Council of the ISI, under the chairmanship of Shri S. L. Kirloskar, took a formal decision to standardize and adopt the metric system of screw threads as the official standard system for use throughout the country.

The question of screw threads for India has been engaging the attention of technical experts in the country for many decades and has been under discussion for the past several years in the ISI Committee on Screw Threads under the chairmanship of Shri R. Krishnamurti, Joint Director of Standardization, Railway Board.

The decision now taken is of far-reaching importance not only in relation to ordinary fasteners such as screws, bolts and nuts, but also would affect the design and manufacture of other equipment where screw threads have a functional role to play. Indian Standards for screws, bolts, nuts and other related items based on the metric system are expected to be made available progressively, starting with a general plan for metric threads from 0.25 mm to 300 millimetres.

Though the ISI has been giving a high priority to this project, considerable delay has taken place in arriving at this decision, due mainly to certain controversies which had to be settled. The ISI now announce that all these controversies have been set at rest and the engineering and other related industries will now be able to plan their production in consonance with the metric policy of Government.

Indian Standards Specification for Rectangular Pressed Steel Tanks (IS : 804-1958)

The ISI has issued an Indian Standard Specification for Rectangular Pressed Steel Tanks (IS: 804-1958). Pressed mild steel tanks have come into use to a large extent because of their ease in erection, facility in transport, standard construction, ease in dismantling and re-erection.

The specification lays down the requirements for the materials, fabrication, erection and supply of rectangular pressed steel tanks used for the storage of cold and hot water and certain other liquids and chemicals, under pressure not greater than the static head corresponding to the depth of the tank. This specification does not cover the requirements of tanks subjected to earth or other external pressure other than wind pressure and of those used to store liquids having temperature higher than 100°C.

Price: Rs. 2.00

Indian Standard Method of Measurement of Building Works (IS : 1200-1958)

Measurement of building works occupies a very important place in the planning and execution of any project from the time the first estimates are made until the final completion and settlement of payments of a project. The methods followed for the measurement of building works are not uniform, and considerable differences exist between the practices followed by one State Government and another and also between the Central

Government; the Central Public Works Department has a system of measurement distinctly different from that followed by the Military Engineer Services.

Again, in private building constructions, architects follow methods of measurement which may be different from any of the systems followed by the Public Works Department. While it is recognized that each system of measurement has to be specifically related to the administrative and financial organization within a department responsible for the work, a unification of the various systems at the technical level has been accepted as very desirable and wanting, specially as it permits a wider circle of operation for builders and building contractors and eliminates ambiguities and misunderstanding of the various systems followed.

Among the systems of measurement followed at present are the Railway Practices, the CPWD Practice and the MES Practice, which are basically the same as the system of measurement recommended by the Institution of Surveyors (India) and the methods of measurement recommended by the Indian Institute of Architects which are largely based on the English Standard Method of Measurement of Building Works published under the joint authority of the Royal Institution of Chartered Surveyors and the National Federation of Building Trades Employers and incorporated in the Condition of Contract of the Royal Institute of British Architects.

With a view to unify the methods of measurement of building works, covered by various bodies and Governments, as far as practicable, ISI has prepared an Indian Standard Method of Measurement of Building Works (IS: 1200-1958).

The standard covers the method of measurement of building works, and applies to the preparation of estimates and bills of quantities, and to site measurements.

Price : Rs. 5.00

Indian Standards Specification for Metric Woven Metallic Tape Measures (IS : 1269-1958)

The ISI has just published an Indian Standard Specification for Metric Woven Metallic Tape Measures (IS : 1269-1958) which prescribes the requirements for metric woven metallic tape measures intended for use where it is not possible to employ rigid measures of length.

This standard is one of a series of Indian Standard Specifications for Commercial Weights and Measures being prepared by the Institution at the instance of the Standing Metric Committee of the Government of India. The other specifications in the series are :

IS : 1056-1957	**Commercial Metric Weights**
IS : 1057-1958	**Metric Carat Weights**
IS : 1058-1958	**Commercial Metric Capacity Measures**
IS : 1059-1957	**Commercial Metric Length Measures (Non-Flexible)**
IS : 1270	**Metric Steel Tape Measures (Winding Type)**

Price : Rs. 1.50

Draft Indian Standard Specification for Fireclay Refractories for Glass Melting Tank Furnaces (Tentative) [Doc : SMDC 18(76)]

The ISI put into circulation an Indian Standard Specification for Fireclay Refractories for Glass Melting Tank Furnaces (Tentative) [Doc : SMDC 18(76).] The need for laying down a suitable specification for refractories for glass industry has been felt for a long time. The glass manufacturers in India have been complaining about the poor quality of refractories now available for the glass industry. According to them the most common defects noticed are that the refractories corrode rapidly, produce stone in glass, they are laminated, underfired and shrink considerably on reheating. Consequently their life is generally poor and seldom exceeds a year. On the other hand the refractory makers have pointed out that in the absence of a specification for refractories for the glass industry it would be difficult for them to satisfy the glass manufacturers. As a result of this a number of tests were conducted in the Central Glass and Ceramic Research

Institute, Calcutta, on the refractories at present being used in the glass industry both indigenous and imported. This standard is based on the results of these tests.

This standard is intended to cover the requirement for fireclay refractories for glass melting tank furnaces upto a maximum size of 60×30×15 cm (or 24×12×6 in.)

The requirement for apparent porosity has at present been specified as not more than 25 percent by volume. It is intendsd that this limit be raised to 22 percent in due course when the Indian manufacturers are able to improve their methods of production.

Draft Indian Standard Specification for Mallable Cast Iron Pipe Fittings [Doc: SMDC 9(68)]

The ISI issued into circulation a draft Indian Standard Specification for Malleable Cast Iron Pipe Fittings [Doc: SMDC 9(68)] which prescribed the types and dimensions ('centre-to-face' and 'face to face' dimensions and their tolerances) for melleable cast iron pipe fittings suitable for screwing to pipe threads in IS : 554-1955. The dimensions specified are essential for interchangeability.

Out of a range of types and sizes of fitting of more than 2,000 items, which had been standardized by various countries of the world, the International Organization for Standardisation, (ISO), has, with the agreement of the participating countries, chosen 638 malleable cast iron fittings, which are necessary for general use and which are being manufactured in mass production. With a view to assisting the industry in India to fall in line with the practice followed in other countries of the world, this standard has been based on the Draft Recommendation of the ISO.

CONVERSION OF WEIGHTS FOR ORDINARY PURPOSES

(4)		(3)		(2)		(1)	(N)	(1A)		(2A)		(3A)		(4A)	
Tons	cwt	Mds	seers	Seers	tolas	Tolas	Number	grams	milli grams	kilo grams	grams	quintals	kilo grams	Metric Tonnes	kilo grams
1	0	2	27	1	6	0.09	**1**	11	664	—	933	—	37	1	16
1	19	5	14	2	11	0.17	**2**	23	328	1	866	—	75	2	32
2	19	8	2	3	17	0.26	**3**	34	991	2	799	1	12	3	48
3	18	10	29	4	23	0.34	**4**	46	655	3	732	1	49	4	64
4	18	13	16	5	29	0.43	**5**	58	319	4	666	1	87	5	80
5	18	16	3	6	34	0.51	**6**	69	983	5	599	2	24	6	96
6	18	18	30	7	40	0.60	**7**	81	647	6	532	2	61	7	112
7	17	21	17	8	46	0.69	**8**	93	310	7	465	2	99	8	128
8	17	24	5	9	52	0.77	**9**	104	974	8	398	3	36	9	144
9	17	26	32	10	57	0.86	**10**	116	638	9	331	3	73	10	160
19	14	53	23	21	35	1.71	**20**	233	276	18	662	7	46	20	321
29	11	80	15	32	12	2.57	**30**	349	914	27	993	11	20	30	481
39	7	107	7	42	69	3.43	**40**	466	552	37	324	14	93	40	642
49	4	133	38	53	47	4.29	**50**	583	190	46	655	18	66	50	802
59	1	160	30	64	24	5.14	**60**	699	828	55	986	22	39	60	963
68	18	187	22	75	1	6.00	**70**	816	466	65	317	26	13	71	123
78	15	214	14	85	59	6.86	**80**	933	104	74	648	29	86	81	284
88	12	241	5	96	36	7.72	**90**	1049	742	83	979	33	59	91	444
98	8	267	37	107	14	8.57	**100**	1166	380	93	310	37	32	101	605

How to Use the Table :

(1) Find the required number from Column (N)

(2) Look up the required value under appropriate column.

(3) Columns (1) and (1A), (2) and (2A), (3) and (3A), (4) and (4A), should be read together. For example, values from (1) and (1A) can be converted but not from (1) and (2A).

Based on IS : 1020—1957 Indian Standard Conversion Tables for Ordinary Use

Example : (1) To convert 20 tolas into grams and milligrams, look up 20 under column (N) and find the equivalent under (1A) viz. 233 grams, 276 milligrams. For converting 20 grams look up under column 1. The value is 1.71 tolas.

(2) To convert 50 kilograms into seers, look up 50 under column (N) and find the equivalent under column (2), viz., 53 seers, 47 tolas. To covert 50 seers look up under column 2A. The value is 46 kg and 655 grams.

CONVERSION TABLES OF PRICES FOR WEIGHTS

TABLE A

(Factor used : 1 kg=1.0717 seers)

Rupees per seer to Rupees per kg

Rs./seer	0 Rs/kg	1 Rs/kg	2 Rs/kg	3 Rs/kg	4 Rs/kg	5 Rs/kg	6 Rs/kg	7 Rs/kg	8 Rs/kg	9 Rs/kg
	0	1.07	2.14	3.22	4.29	5.36	6.43	7.50	8.57	9.65
10	10.72	11.79	12.86	13.93	15.00	16.08	17.15	18.22	19.29	20.36
20	21.43	22.51	23.58	24.65	25.72	26.79	27.86	28.94	30.01	31.08
30	32.15	33.22	34.29	35.37	36.44	37.51	38.58	39.65	40.72	41.80
40	42.87	43.94	45.01	46.08	47.15	48.23	49.30	50.37	51.44	52.51
50	53.58		...	...	...	...	..	...		...

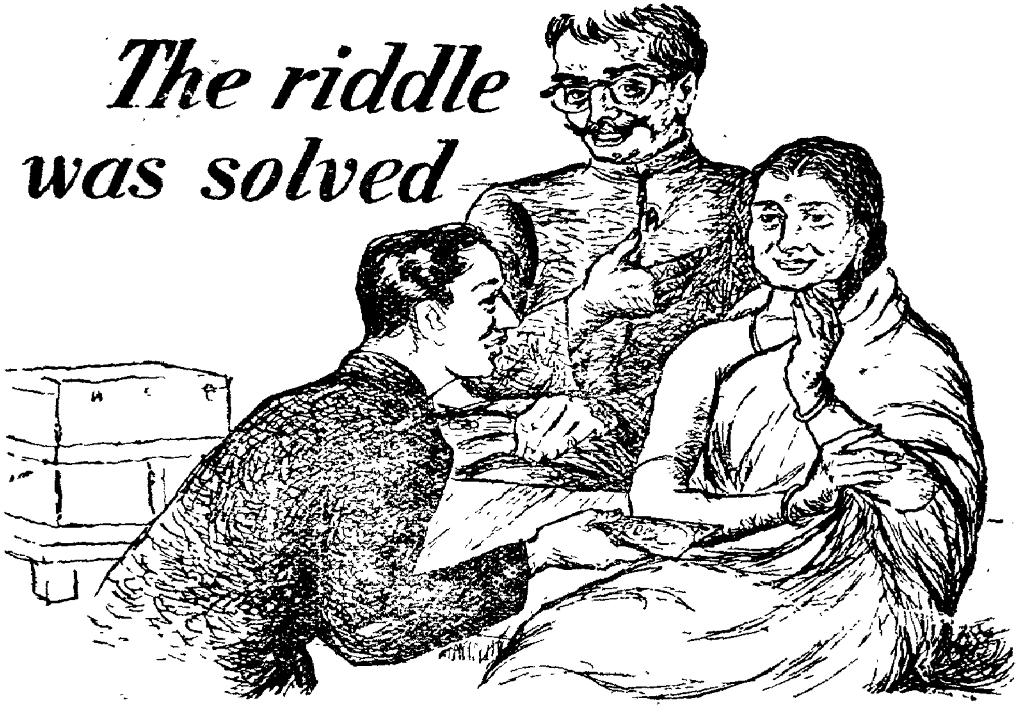
TABLE B

(Factor used : 1 kg = 1.0717 seers)

Naye Paise per seer to Naye Paise per kg

nP/Seer	0 nP/kg	1 nP/kg	2 nP/kg	3 nP/kg	4 nP/kg	5 nP/kg	6 nP/kg	7 nP/km	8 nP/kg	9 nP/kg
0	0	1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18	19	20
20	21	23	24	25	26	27	28	29	30	31
30	32	33	34	35	36	38	39	40	41	42
40	43	44	45	46	47	48	49	50	51	53
50	54	55	56	57	58	59	60	61	62	63
60	64	65	66	68	69	70	61	72	73	74
70	75	76	77	78	79	80	81	82	83	85
80	86	87	88	89	90	91	92	93	94	95
90	96	98	99	100	101	102	103	104	105	106
100	107	..	..	..	..	..	..	..	..	..

The riddle was solved



I am a civil engineer My father was an ordinary office clerk. I could not explain my expensive education until 5 years ago when I brought home my first salary cheque. That was the day when my father told me he had sold my mother's jewellery years ago and invested the proceeds in National Savings Certificates. He had also been adding to this investment by regular savings He enjoined upon me to save regularly and invest likewise and I am glad I heeded him. Today I have a small capital which I am using for advanced studies abroad

Investments in NATIONAL PLAN SAVINGS CERTIFICATES and other Small Savings Scheme securities of the Government come back to you with tax-free interest. They serve you and the NATION by providing resources for the country's development.

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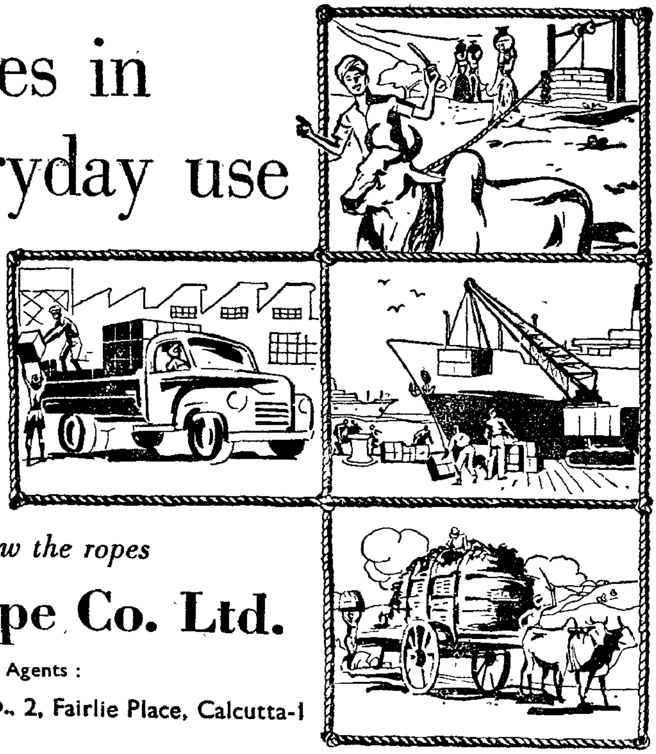
NATIONAL SAVINGS ORGANIZATION

Further particulars and/or rules governing these investments available from the National Savings Commissioner, Nagpur or the Regional National Savings Officer of your State.

Ganges Ropes in everyday use



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